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EVALUATION OF SEEDLING MORTALITY IN THE ROOSEVELT PLANTATION, SAN JACINTO RANGER DISTRICT, SAN BERNARDINO NATIONAL FOREST

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ABSTRACT

Mortality of five-year-old plantation seedlings of Jeffrey pine was caused by the girdling of larvae that appeared to be the California flatheaded borer, Melanophila californica. Drought, competing vegetation and planting technique were contributory factors to this unusual pest problem.

INTRODUCTION

On November 1, 1988, I and Susan Frankel, plant pathologist, accompanied Ernest Del Rio, silviculturist, and Kathy Valenzuela, resource officer, to the Roosevelt Plantation in the Apple Canyon area of the San Jacinto Ranger District, San Bernardino National Forest. The objective was to examine seedling mortality and determine the cause, and develope management alternatives.

OBSERVATIONS

The plantation was initiated in 1983 when 8800 2-0 Jeffrey and Coulter pines were treated with terra-sorb and vitamin B-1 and auger planted in hand-scalped spots after disking. First-year survival was 90%. Survival declined to 22% by the third year, about 175 seedlings per acre, and is now in the order of 10%. An abundant cover of sage provides most of the vegetative competition (Fig. 1).

Of the 27 acres in the plantation, only the corner where mortality was heaviest was examined. Outwardly, the seedlings often developed a leaning or curved growth form before browning and dying. A slight swelling of the stem occurred

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a few inches above the soil line. The bark at this point was frequently cracked, while it was smooth elsewhere along the stem.

Extraction of seedlings indicated that some had been planted somewhat too deeply. Also, roots had been twisted together when inserted into the hole and this prevented proper orientation of root zone expansion. Both conditions would cause stress in addition to that caused by several seasons of subnormal precipitation.

Upon removal of the outer bark, galleries of flatheaded borers were found. These were sometimes quite extensive and always girdled the seedling at or below the swelling. More often than not, seedlings could be easily snapped at one or more points along the stem. Larval mines ran through the stem interior for various lengths and contained a fine, dry boring dust. Up to three larvae per seedling were found, and examinations indicated that up to four or five larvae might occur in a seedling.

Larvae examined were of two distinct sizes, indicating different years of attack or a life cycle of variable length determined by environmental constraints, or both. Larvae appeared to be identical to larvae removed from under the bark of nearby dying mature Jeffrey pine. It was deduced that the insect girdling the seedlings and tunneling their interior was the same as that in the larger trees -- the California flatheaded borer, Melanophila californica. Stems containing larvae were placed in rearing in order to obtain adults for positive identification.

Not all attacked seedlings were brown. Some were only slightly off color and several green trees exhibited the stem swelling. These probably will die also. The proportion of trees without attacks was not determined, but overall survival presently is declining and under 10% in the area examined.

DISCUSSION

A combination of stresses causing susceptibility and a nearby population of flatheaded borers has resulted in unacceptable levels of mortality in Roosevelt Plantation. The mortality of seedlings brought about by successful attacks of the California flatheaded borer is a most unusual occurrence. None of the present Forest Pest Management personnel have previously observed a similiar situation.

Irrigation is impractical at the site and, of the present stresses on the seedlings, immediate mitigation will occur only for moisture stress with the return of normal precipitation levels. This in turn will reduce the population levels of the California flatheaded borer by increasing the vigor of nearby forests. Only time will allow seedlings to overcome stresses induced by errors in planting technique.

MANAGEMENT ALTERNATIVES

No Action. It presently appears that normal or above normal levels of precipitation will occur in the winter of 1988-89. This will alleviate much of the stress on the seedlings and minimize the probability of survival of

hatching larvae or first-stage larvae already under the bark. However, older larvae may proceed to girdle host seedlings. Those seedlings in which larvae die may exhibit flat patches of bark until callusing heals the wounds. Should soil moisture continue to be subnormal during the spring growing season, the remaining seedlings probably will continue to be attacked.

Spray Treatment. Sevin 50W and 80S are currently registered chemicals for preventing successful attacks upon pines by bark beetles. They might also prevent successful oviposition upon the seedlings by the California flatheaded borer. Treatment could be done by any small spray apparatus. Use of either chemical would have to comply with directions of the county agricultural commissioner. Treatment should not occur while the sage is in flower in order to avoid contact with foraging bees.

Silvicultural. A possible silviculture alternative would be the hand removal of sage plants adjacent to seedlings in order to reduce vegetative competition. Local experience should indicate the feasibility and benefits to be derived from such an effort. Any relief in stress so gained would assist the seedlings in resisting successful attack and development by the California flatheaded borer. Tighter quality control of planting would be beneficial to prevent attacks in future plantations similarly located.

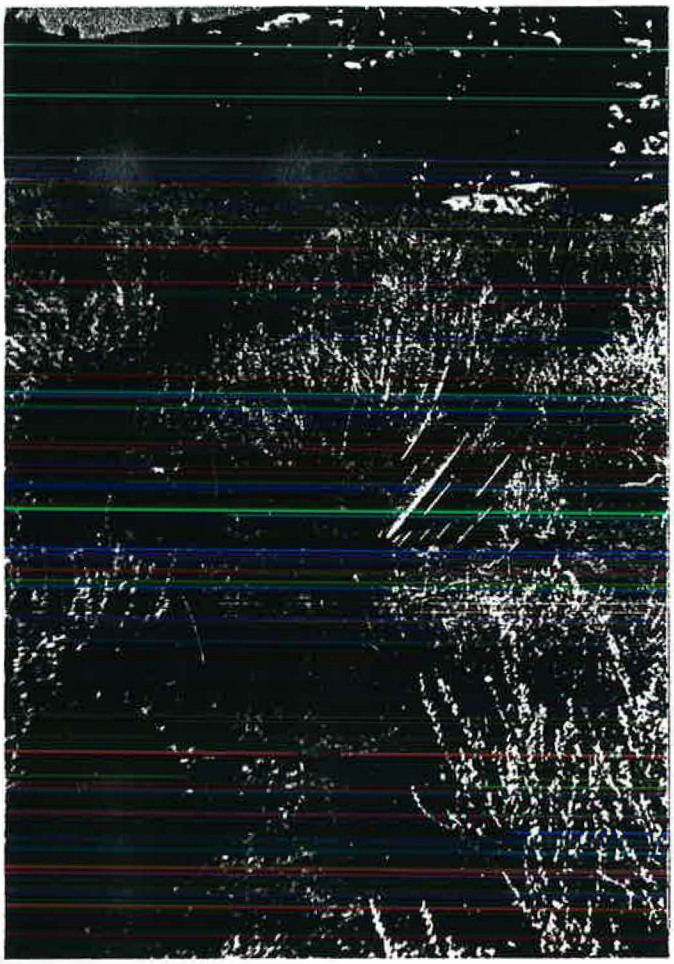

Figure 1. A healthy Jeffrey pine seedling in the Roosevelt Plantation, San Jacinto Ranger District, San Bernardino National Forest.